

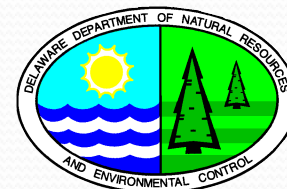
A Comprehensive Approach for Sustaining Delaware Marshes Against the Impacts of Sea Level Change

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Bartholomew Wilson, P.G.

DNREC Delaware Coastal Programs

Part I: Who We Are



Coastal Habitat Conservation in a Changing Climate:
Strategies and Tools in the Mid-Atlantic Region



Delaware Coastal Programs

- Delaware Coastal Management Program
- Delaware National Estuarine Research Reserve
 - St. Jones River Component
 - Blackbird Creek Component



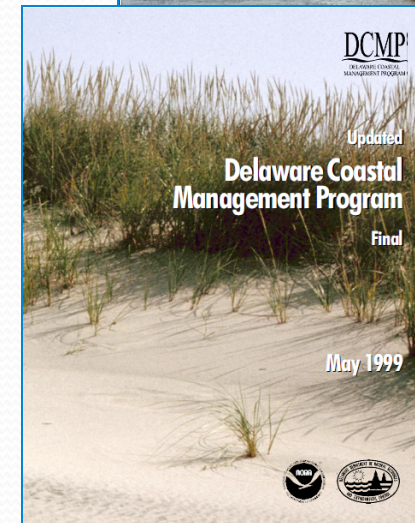
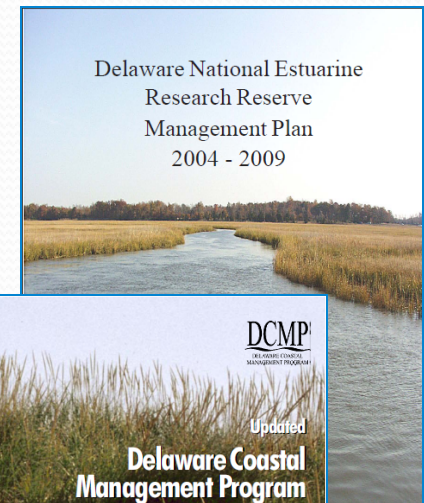
*St. Jones
River*



*Blackbird
Creek*

Assets of DCP

- Extensive GIS capabilities and experience
- Diverse quality GIS datasets
- Modeling experience, hardware and software
- Geological expertise
- Management support for research
- Dedicated funding for research
- Access to needed scientific equipment
- DNERR research sites
- Enforceable policies for coastal management



DNERR Research Goal

- DNERR Management Plan 2004-2009
 - “To identify the various types, quality, and quantity of habitats available in the estuary to facilitate the proper management and protection of the estuarine ecosystem”
- DNERR Management Plan 2010-2015 *(Proposed)*
 - To further the understanding of historic and current conditions and processes of the estuary to improve science-based decision making for proper management of the State’s estuarine resources

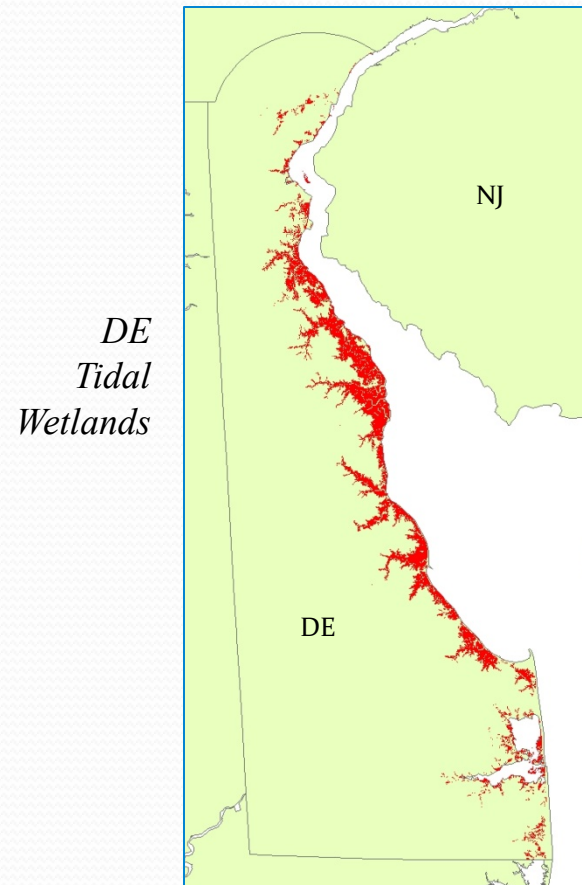
DNERR Marsh Characterization

- SWMP (1995-)
 - Abiotic
 - Meteorological
 - Nutrients
- GRF Research (1996-)
- SETs(2004-)
- Sediment Cores (2006-)
- Elevation (2008-)
 - Vertical control
 - Site specific measurements



Who Owns DE Tidal Wetlands?

- State of Delaware – 34%
- USFWS– 11%
 - Bombay Hook NWR
 - Prime Hook NWR
- NGOs – 11%
 - The Nature Conservancy
 - Delaware Wildlands
 - Others
- Privately owned – 44%
- Covered by State Wetlands Act – 100%



Part II: Work with DE Refuges



Coastal Habitat Conservation in a Changing Climate:
Strategies and Tools in the Mid-Atlantic Region



Delaware Bay Refuge Complex

- Bombay Hook NWR
 - ~16,000 acres
 - ~13,000 acres tidal marsh
 - ~1100 acres impoundments
- Prime Hook NWR
 - ~10,000 acres
 - ~2300 acres of tidal marsh
 - ~4200 acres of impounded freshwater marsh



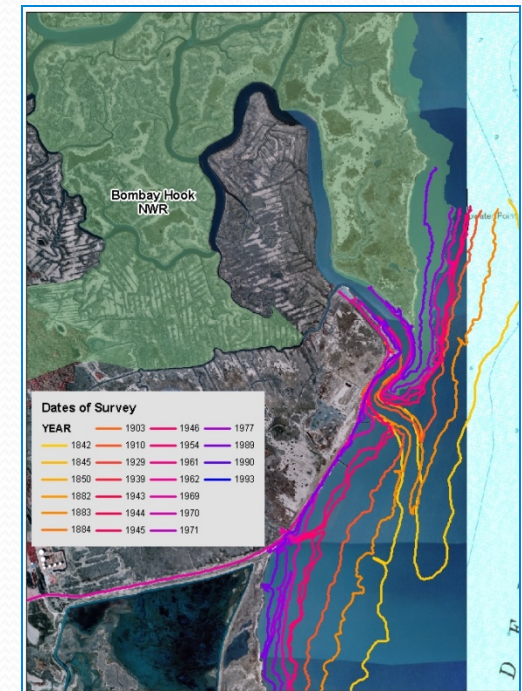
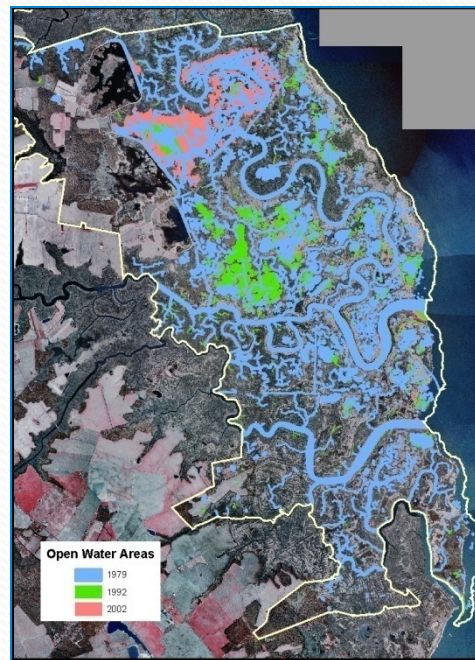
Can You Help Us? *(Part 1)*

- Bombay Hook NWR
 - Significant degradation and loss of vegetative tidal marsh (marsh drowning)
 - Needed to quantify degradation and identify potential management actions



Open Water Analysis Results

- 1937 – 2002
 - 506 shoreline acres loss
 - 7.8 acres /year
- 1979 - 2002
 - 12% interior marsh loss
 - 1340 acres
 - 58 acres/year



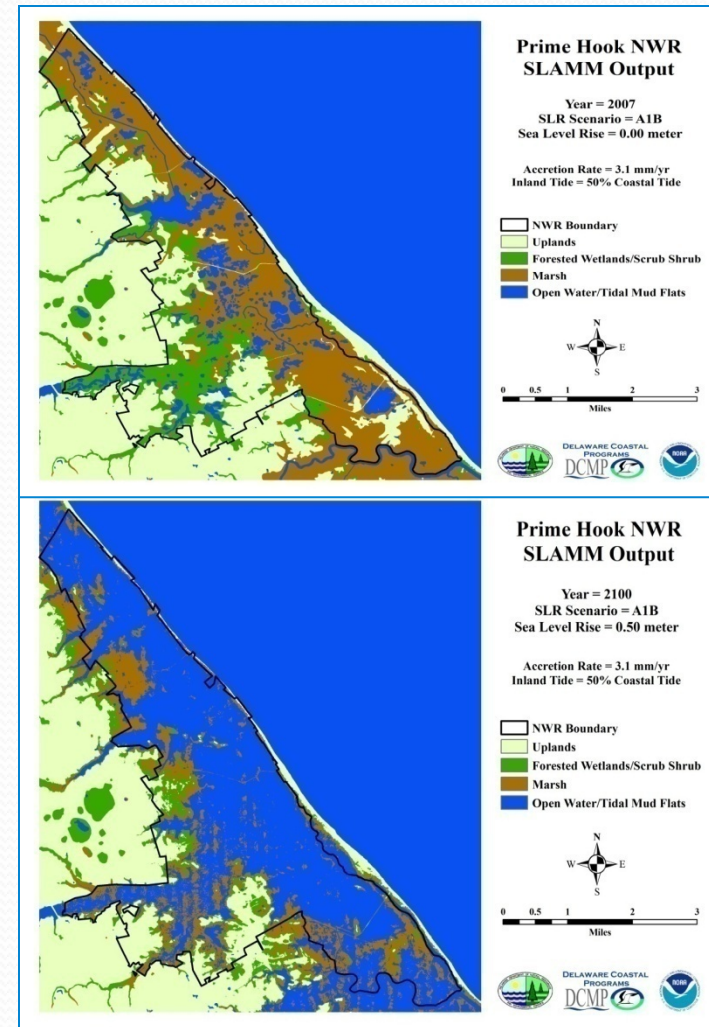
Can You Help Us? *(Part 2)*

- Prime Hook NWR updating CCP
 - Required to use SLAMM
- State had recently acquired LiDAR for Sussex County
- DCP looking for target area to evaluate SLAMM with high resolution data.



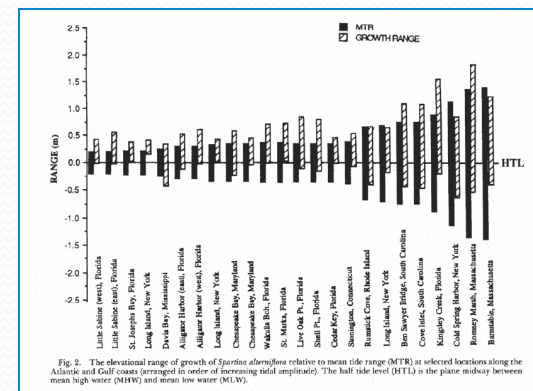
SLAMM Results

- Future of the Refuge
 - Open water areas and mudflats will increase
 - By 2050 half of current uplands may be lost
- Evaluation of the model
 - Limited suitability for localized modeling
 - Habitats should be aggregated
 - Need feedback loops
- Need for better data



Another Consideration (Don Cahoon, USGS)

- Marsh Vulnerability Index (MVI)
 - Based on paper by Patrick & McKee
 - *Spartina alterniflora* has preferred growth zone in tidal regime
 - Location of target marsh in regime indicator of vulnerability to SLR
 - MVI “calibrated” for Delaware in DNERR marshes



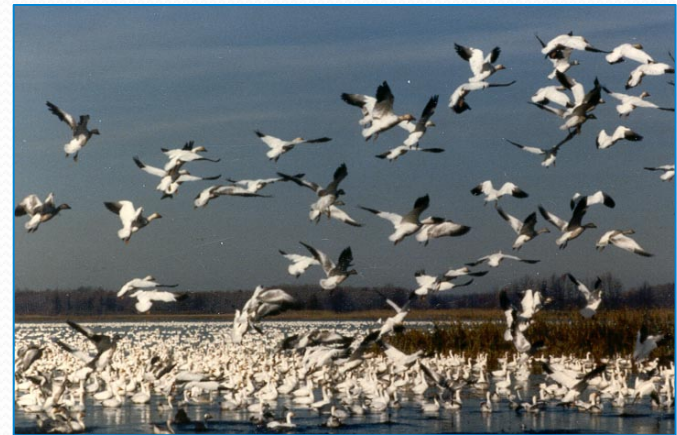
More Help, *Please*

- Meetings with DCP & NWR to assist with SLR management issues
 - Marsh loss
 - Impoundment breaches
 - Nutrient/salinity changes
 - Prime Hook area coastal communities
 - Infrastructure subsidence



DCP/NWR Cooperative Projects

- Water Level & Salinity Monitoring Network
- Suspended Sediment & Nutrient Monitoring
- Marsh/Impoundment Elevation Transects
- Salinity Transects
- Sediment Elevation Tables
- Sediment Cores
- Hydrodynamic Analysis
- Marsh Health Assessments
- Infrastructure Surveys

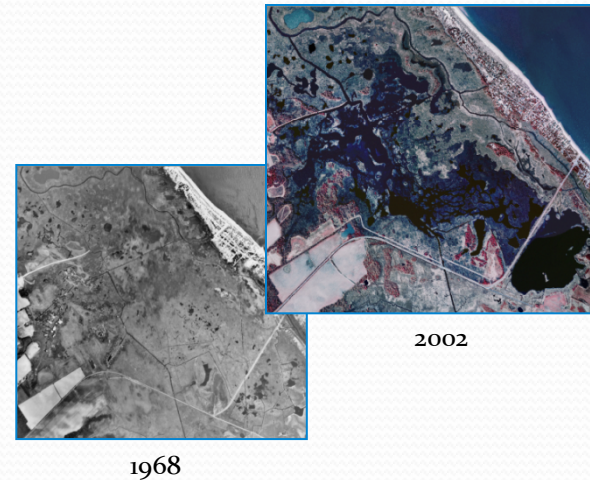


Part III: Past, Present & Future



Past

- Photos (1937-2007)
 - Erosion
 - Open water changes
 - Vegetation changes
- Cores
 - Shallow – 50-100 years of marsh dynamics
 - Deep - 1000's of years marsh dynamics
- Tidal data
 - Localized SLR



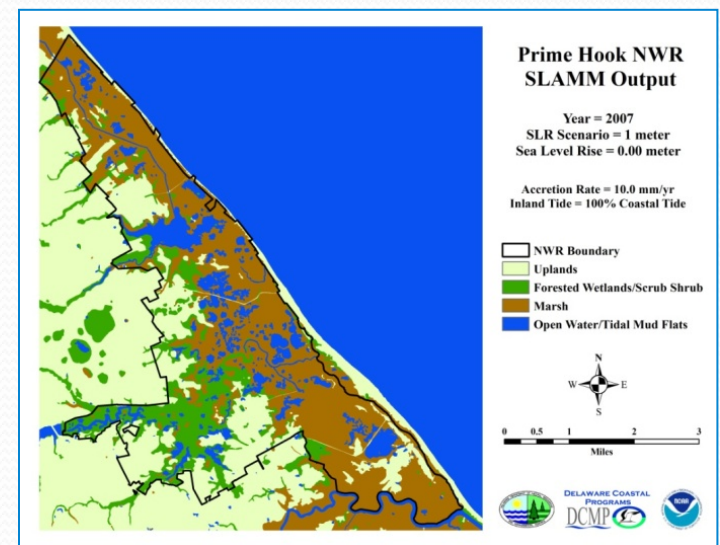
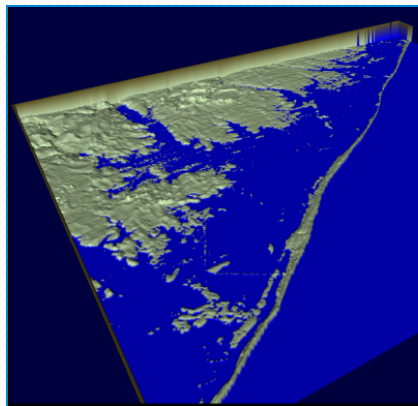
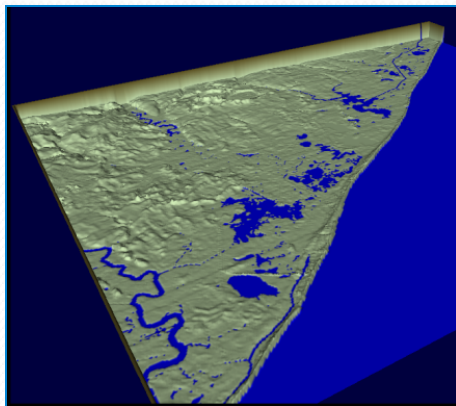
Present

- SETs
 - Accretion rates
 - Shallow subsidence rates
- MVI
 - Optimal *Spartina* growth ranges
- LiDAR
- Survey transects
 - Accurate elevations of marshes
 - Impoundments
- Water monitoring
 - Levels
 - Salinity
 - Etc.



Future

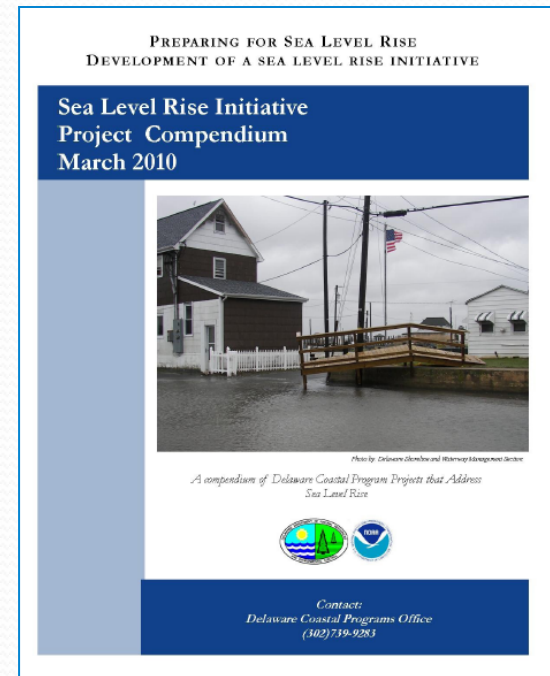
- Sea Level Affecting Marshes Model (SLAMM)
 - 100 year projections of habitat change
- DHI Mike Flood Model
 - Event based hydrodynamic model



Applying Science to Management

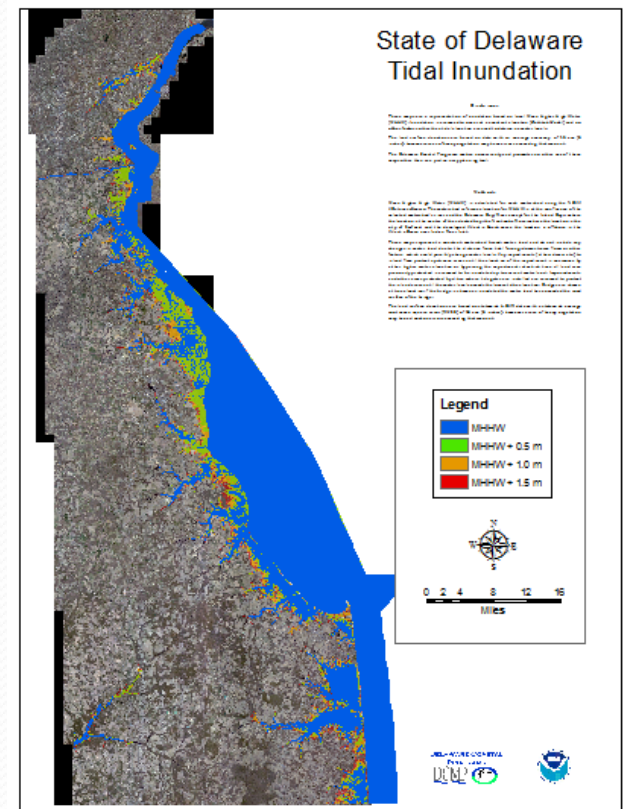
- Projection of future conditions of DE marshes
- As we get more information we can improve the projections
- Different management options can be analyzed
- Anticipate and promote needed changes to land protection and management strategies

Part IV: Next Steps



Proactive Planning

- Develop vulnerability assessments based upon inundation maps
- Using best available information refine resources at risk and potential adaptation responses
- Pilot Projects
 - Assist NWR with adaptive management plans
 - Assist DNREC programs with SLR adaptation planning
 - DFW impoundment management



SLR Adaptation Planning

- Understanding physical changes and how they relate and interact with real world issues
- 4 Scenarios
 - Do nothing and let nature do its thing
 - Fortify and protect existing conditions
 - Retreat and rebuild inland
 - Combination of above

Real World Issues

- Economic factors
 - Immediate costs
 - Long-term costs
 - Secondary costs
- Social factors
 - Displacement
 - Loss of Benefits
 - Etc.
- Legal factors
 - Permitting
 - Property rights
 - Etc.
- Environmental factors
 - Habitat
 - Pollution
 - Etc.

DCP Sea Level Rise Workshops

- Goal – Provide the answers to the questions that decision makers have in order for them to make science-based management decisions with the best available information



DCP SLR Workshop Template

- Gathering of decision makers
 - Describe the 4 scenarios
 - Explain the 4 factors as they relate to each scenario
 - Progress through each factor/scenario and gather questions
- Workshop of experts
 - Convene workshop(s) of experts to answer questions or suggest methods to acquire needed information
- Supply decision makers with all available information

Part V: Barriers & Needs



Barriers Encountered

- Limited recognition of advantages and the need to address sea level rise problems proactively
- Need for a unified voice from those in authority
- Bureaucratic inertia
- Quantity and quality of data
- Turf
- Funding & staff

Information Needs

- Complete spatial coverage of datasets
 - Accretion rates
 - Subsidence rates
 - Erosion rates
- Low-tide LiDAR
- Improved SLR predictive model results
- More information/research on feedbacks
 - Accretion rates to SLR
 - Habitat changes to salinity & water level changes
 - Wildlife responses to habitat changes

Assistance Needs *(Please help us)*

- Federal leadership supporting local monitoring & SLR response activities
- Educating public/officials
- Federal/State common message
- Policies that promote SLR resiliency
- Re-survey/common datum for infrastructure
- Funding for adaptation actions (retreat and/or fortify)

Partners

- NOAA / OCRM, ERD & CSC
- USFWS / Coastal Delaware Refuge Complex
- DNREC / Div of Fish and Wildlife
- DNREC / DWR / Watershed Assessment Section
- UD / College of Earth Ocean & Environment
- Delaware Geological Survey
- The Nature Conservancy / Delaware Chapter
- Center for the Inland Bays
- Delaware EPSCoR

Contacts

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